



The **CRUSHED STONE JOURNAL**

PUBLISHED QUARTERLY

In This Issue

■

The National Crushed Stone Association
Safety Competition of 1945

■

A Tribute to E. J. Krause

■

Highway Building—A National "Must"



December • 1946

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The Crushed Stone Journal

Official Publication of the NATIONAL CRUSHED STONE ASSOCIATION

J. R. BOYD, Editor

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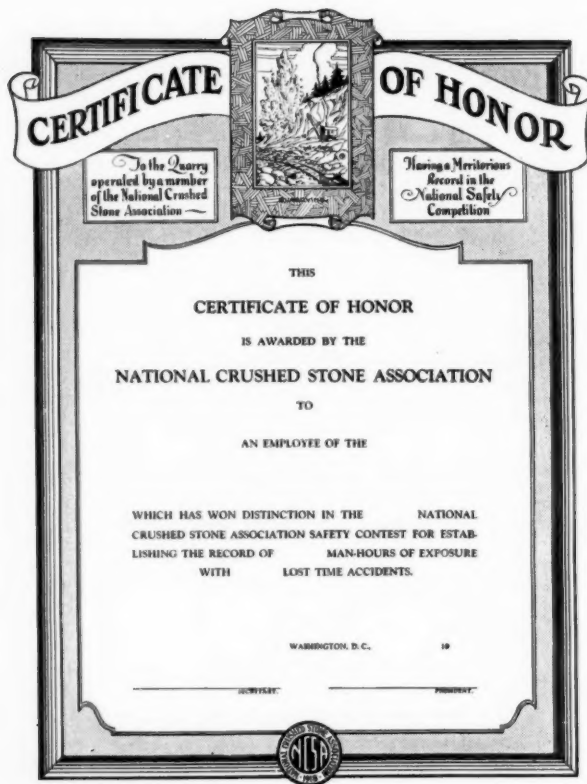
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THIS Certificate of Honor will be presented to each employee of each plant which completed the year 1945 with no lost time accidents.

THE CRUSHED STONE JOURNAL

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DECEMBER, 1946

The National Crushed Stone Association Safety Competition of 1945

By J. I. DAVIS
R. W. ARTHUR

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Economics and Statistics Branch,
U. S. Bureau of Mines.

FOR THE first time in the 20-year history of the National Crushed Stone Association Safety Competition there were no fatal injuries at any of the enrolled quarries or mines according to the Bureau of Mines, United States Department of the Interior. As a result of this safety achievement, the 53 competing operations which were worked approximately $7\frac{1}{4}$ million man-hours had a severity rate of only 1.093 days lost per thousand hours of work, by far the lowest annual rate since the contests were started in 1926. The frequency of occurrence of injuries also was improved markedly, and the 1945 rate of 21.840 injuries per million man-hours of work was nearly one-third lower than the average rate of 31.981 during the 20-year history of the contests.

The competing plants had only 3 permanent partial disabilities which were charged with 3,750 days in accordance with the standard time-loss scale. The total of 157 temporary lost-time injuries had an average of 27 days lost per injury. All told, 8,010 days were lost through injuries at the enrolled plants, an economic loss of production equivalent approximately to 100 men working 80 full shifts.

Injury experience was improved sharply at both the quarries and underground mines entered in the 1945 competition. At the 46 competing quarries, the

severity rate of 0.699 day lost per thousand hours of work was the lowest annual rate by a large margin since the contests started in 1926 and the frequency of 22.343 injuries per million hours was nearly one-third lower than the average rate for the past 20 years. At the 7 enrolled underground mines the severity rate of 3.031 and frequency rate of 19.373 were reduced to less than half the corresponding 20-year average rates since 1926.

The increased enrollment of 53 plants in the 1945 competition indicates the generally increasing use of safety competitions as a tool for promoting accident-prevention work at mineral operations. In recent years safety at mines and quarries has become a factor of primary economic importance in addition to its customary humanitarian consideration. Safety competitions are recognized as an effective means of intensifying accident-prevention work and of keeping safety uppermost in the employees' thoughts.

Winning Plant

The Bessemer limestone quarry of the Bessemer Limestone and Cement Company at Bessemer, Pennsylvania had the best safety record in 1945, and the bronze plaque provided by the *Explosives Engineer* magazine was awarded to this operation. Employees

TABLE 1
RELATIVE STANDING OF QUARRIES IN THE 1945 NATIONAL CRUSHED STONE ASSOCIATION SAFETY
COMPETITION, BASED UPON THE ACCIDENT-SEVERITY RATES OF THE QUARRIES¹

Rank of plant	Man- hours worked	Number of injuries ²					Average days of disability per temp. injury	Number of days of disability ²					Frequency rate ¹	Severity rate ¹
		F.	P.T.	P.P.	Temp.	Total		F.	P.T.	P.P.	Temp.	Total		
1	298,837	—	—	—	—	—	—	—	—	—	—	—	0.000	0.000
2	234,822	—	—	—	—	—	—	—	—	—	—	—	.000	.000
3	117,462	—	—	—	—	—	—	—	—	—	—	—	.000	.000
4	99,029	—	—	—	—	—	—	—	—	—	—	—	.000	.000
5	90,877	—	—	—	—	—	—	—	—	—	—	—	.000	.000
6	84,480	—	—	—	—	—	—	—	—	—	—	—	.000	.000
7	84,361	—	—	—	—	—	—	—	—	—	—	—	.000	.000
8	70,792	—	—	—	—	—	—	—	—	—	—	—	.000	.000
9	61,848	—	—	—	—	—	—	—	—	—	—	—	.000	.000
10	60,066	—	—	—	—	—	—	—	—	—	—	—	.000	.000
11	47,970	—	—	—	—	—	—	—	—	—	—	—	.000	.000
12	44,872	—	—	—	—	—	—	—	—	—	—	—	.000	.000
13	42,714	—	—	—	—	—	—	—	—	—	—	—	.000	.000
14	37,836	—	—	—	—	—	—	—	—	—	—	—	.000	.000
15	29,344	—	—	—	—	—	—	—	—	—	—	—	.000	.000
16	27,026	—	—	—	—	—	—	—	—	—	—	—	.000	.000
17	10,223	—	—	—	—	—	—	—	—	—	—	—	.000	.000
18	86,314	—	—	—	1	1	1	—	—	—	1	1	11.586	.012
19	63,907	—	—	—	1	1	2	—	—	—	2	2	15.648	.031
20	311,796	—	—	—	2	2	11	—	—	—	21	21	6.414	.067
21	128,617	—	—	—	2	2	6	—	—	—	12	12	15.550	.093
22	102,648	—	—	—	4	4	6	—	—	—	22	22	38.968	.214
23	145,830	—	—	—	2	2	20	—	—	—	39	39	13.715	.267
24	40,137	—	—	—	2	2	6	—	—	—	11	11	49.829	.274
25	99,960	—	—	—	4	4	7	—	—	—	28	28	40.016	.280
26	114,978	—	—	—	4	4	8	—	—	—	33	33	34.789	.287
27	67,714	—	—	—	2	2	12	—	—	—	24	24	29.536	.354
28	369,750	—	—	—	2	2	72	—	—	—	143	143	5.409	.387
29	208,601	—	—	—	7	7	12	—	—	—	86	86	33.557	.412
30	56,350	—	—	—	1	1	24	—	—	—	24	24	17.746	.426
32	22,848	—	—	—	2	2	5	—	—	—	10	10	87.535	.438
34	210,750	—	—	—	8	8	13	—	—	—	101	101	37.960	.479
36	196,882	—	—	—	4	4	28	—	—	—	111	111	20.317	.564
37	170,067	—	—	—	7	7	15	—	—	—	102	102	41.160	.600
38	98,310	—	—	—	1	1	61	—	—	—	61	61	10.173	.620
39	105,022	—	—	—	4	4	20	—	—	—	81	81	38.087	.771
40	88,600	—	—	—	2	2	36	—	—	—	72	72	22.573	.813
41	642,331	—	—	—	11	11	49	—	—	—	543	543	17.125	.845
42	73,485	—	—	—	4	4	18	—	—	—	72	72	54.433	.980
43	49,569	—	—	—	1	1	59	—	—	—	59	59	20.174	1.190
45	233,343	—	—	—	17	17	17	—	—	—	281	281	72.854	1.204
47	181,863	—	—	—	11	11	24	—	—	—	261	261	60.485	1.435
48	41,399	—	—	—	1	1	83	—	—	—	83	83	24.155	2.005
49	177,401	—	—	—	8	8	49	—	—	—	394	394	45.096	2.221
50	65,210	—	—	—	1	1	183	—	—	—	183	183	15.335	2.806
51	490,796	—	—	1	19	20	34	—	—	750	645	1,395	40.750	2.842
Totals and rates 1945	6,087,037	—	—	1	135	136	26	—	—	750	3,505	4,255	22.343	0.699
Totals and rates 1944	3,996,433	3	—	4	118	125	28	18,000	—	3,000	3,323	24,323	31.278	6.086

¹ As reports from mining companies are considered confidential by the Bureau of Mines, the identities of the plants to which this table relates are not revealed.

² F., fatal; P.T., permanent total disability; P.P., permanent partial disability; Temp., temporary disability.

³ Frequency rate indicates the number of fatal, permanent, and other disabling injuries per million man-hours of exposure; severity rate indicates number of days of disability lost from injuries per thousand man-hours of exposure.

TABLE 2

RELATIVE STANDING OF UNDERGROUND MINES IN THE 1945 NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION, BASED UPON THE ACCIDENT-SEVERITY RATES OF THE MINES¹

Rank of plant	Man-hours worked	Number of injuries ¹					Average days of disability per temp. injury	Number of days of disability ¹					Frequency rate ¹	Severity rate ¹
		F.	P.T.	P.P.	Temp.	Total		F.	P.T.	P.P.	Temp.	Total		
31	279,214	—	—	—	4	4	30	—	—	—	121	121	14.326	0.433
33	141,787	—	—	—	5	5	13	—	—	—	67	67	35.264	.473
35	266,389	—	—	—	7	7	20	—	—	—	138	138	26.277	.518
44	85,575	—	—	—	2	2	51	—	—	—	102	102	23.371	1.192
46	39,512	—	—	—	2	2	26	—	—	—	51	51	50.618	1.291
52	399,360	—	—	1	1	2	270	—	—	1,800	270	2,070	5.008	5.183
53	27,008	—	—	1	1	2	6	—	—	1,200	6	1,206	74.652	44.653
Totals and rates, 1945	1,238,845	—	—	2	22	24	34	—	—	3,000	755	3,755	19.373	3.031
Totals and rates, 1944	727,496	1	—	1	27	29	29	6,000	—	2,400	796	9,196	39.863	12.641

¹ See footnotes 1, 2, and 3, Table 1.

worked 298,837 man-hours throughout the year without a disabling accident. The Bessemer quarry has been enrolled 10 years since the competition started, and of these 10 years, 2 were free of accidents. In each of these years with perfect safety records—1943 and 1945—the operation has won the trophy.

Accident Free Plants

Fifteen plants received honorable mention for operating throughout the year with accident-free records and were awarded parchment reproductions of the quarry scene on the bronze plaque. Each employee of a plant that has an accident-free record is

TABLE 3

YEARLY SUMMARY—QUARRIES IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION, 1926-1945¹

Year	Plants	Man-hours worked	Number of injuries ¹					Number of days of disability ¹					Frequency rate ¹	Severity rate ¹
			Fatal	P.T.	P.P.	Temp.	Total	Fatal	P.T.	P.P.	Temp.	Total		
1926	40	5,298,983	3	—	6	207	216	18,000	—	9,000	4,239	31,239	40.763	5.895
1927	48	7,876,791	9	—	2	458	469	54,000	—	2,100	7,186	63,286	59.542	8.034
1928	53	7,509,098	8	—	4	322	334	48,000	—	8,700	5,493	62,193	44.479	8.282
1929	53	7,970,325	4	—	5	286	295	24,000	—	5,760	5,533	35,293	37.012	4.428
1930	68	8,013,415	6	—	9	227	242	36,000	—	7,250	3,671	46,921	30.199	5.855
1931	58	5,085,857	4	—	13	198	215	24,000	—	18,660	3,540	46,200	42.274	9.084
1932	40	2,661,850	1	—	4	75	80	6,000	—	6,750	2,481	15,231	30.054	5.722
1933	40	2,704,871	1	—	1	67	69	6,000	—	48	2,893	8,941	25.510	3.306
1934	46	3,288,257	1	—	2	106	109	6,000	—	2,850	1,873	10,723	33.148	3.261
1935	46	4,166,306	2	1	8	77	88	12,000	6,000	9,900	3,015	30,915	21.122	7.420
1936	50	6,399,023	5	—	14	182	201	30,000	—	8,168	4,590	42,758	31.411	6.682
1937	47	6,199,001	7	—	9	136	152	42,000	—	5,875	4,461	52,336	24.520	8.443
1938	47	4,658,119	2	—	6	76	84	12,000	—	6,600	3,184	21,784	18.033	4.677
1939	44	4,219,086	2	—	2	51	55	12,000	—	4,800	1,678	18,478	13.036	4.380
1940	46	4,358,409	1	—	5	78	84	6,000	—	2,550	3,013	11,563	19.273	2.653
1941	47	5,777,587	3	—	5	98	106	18,000	—	9,300	2,266	29,566	18.347	5.117
1942	48	7,178,935	3	2	1	183	189	18,000	12,000	1,500	4,239	35,739	26.327	4.978
1943	34	4,750,314	4	—	5	134	143	24,000	—	7,146	3,862	35,008	30.103	7.370
1944	32	3,996,433	3	—	4	118	125	18,000	—	3,000	3,323	24,323	31.278	6.086
1945	46	6,087,037	—	—	1	135	136	—	—	750	3,505	4,255	22.343	0.699
Total	—	108,199,697	69	3	106	3,214	3,392	414,000	18,000	120,707	74,045	626,752	31.349	5.793

¹ See footnotes 1, 2, and 3, Table 1.

TABLE 4
YEARLY SUMMARY—UNDERGROUND MINES IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION, 1926-45¹

Year	Plants	Man-hours worked	Number of injuries ¹					Number of days of disability ¹					Frequency rate ¹	Severity rate ¹
			Fatal	P.T.	P.P.	Temp.	Total	Fatal	P.T.	P.P.	Temp.	Total		
1926	3	517,926	—	—	—	34	34	—	—	—	533	533	65.646	1.029
1927	2	318,449	1	—	1	14	16	6,000	—	300	68	6,368	50.244	19.997
1928	5	542,193	1	—	1	68	70	6,000	—	300	888	7,188	129.105	13.257
1929	4	665,520	1	—	1	30	32	6,000	—	300	617	6,917	48.083	10.393
1930	6	595,367	1	—	1	15	17	6,000	—	225	468	6,693	28.554	11.242
1931	3	345,105	—	—	—	4	4	—	—	—	147	147	11.591	.426
1932	2	158,450	—	—	—	6	6	—	—	—	165	165	37.867	1.041
1933	3	229,381	—	—	—	11	11	—	—	—	349	349	47.955	1.521
1934	4	248,146	—	—	—	13	13	—	—	—	287	287	52.389	1.157
1935	2	175,994	—	—	—	3	3	—	—	—	249	249	17.046	1.415
1936	4	334,747	1	—	—	7	8	6,000	—	—	117	6,117	23.899	18.274
1937	3	364,680	—	—	—	3	3	—	—	—	91	91	8.226	.250
1938	3	334,442	—	—	—	2	2	—	—	—	133	133	5.980	.398
1939	4	393,039	—	—	1	7	8	—	—	600	457	1,057	20.354	2.689
1940	4	375,987	—	—	1	8	9	—	—	4,500	888	5,388	23.737	14.330
1941	4	591,568	—	—	1	15	16	—	—	750	169	919	27.047	1.553
1942	4	785,894	—	—	1	33	34	—	—	1,800	1,213	3,013	43.263	3.834
1943	5	1,019,771	—	—	3	45	48	—	—	4,950	1,123	6,073	47.069	5.955
1944	4	727,496	1	—	1	27	29	6,000	—	2,400	796	9,196	39.863	12.641
1945	7	1,238,845	—	—	2	22	24	—	—	3,000	755	3,755	19.373	3.031
Total	—	9,963,000	6	—	14	367	387	36,000	—	19,125	9,513	64,638	38.844	6.488

¹ See footnotes 1, 2, and 3, Table 1.

TABLE 5
YEARLY SUMMARY—QUARRIES AND UNDERGROUND MINES IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION, 1926-45¹

Year	Plants	Man-hours worked	Number of injuries ¹					Number of days of disability ¹					Frequency rate ¹	Severity rate ¹
			Fatal	P.T.	P.P.	Temp.	Total	Fatal	P.T.	P.P.	Temp.	Total		
1926	43	5,816,909	3	—	6	241	250	18,000	—	9,000	4,772	31,772	42.978	5.462
1927	50	8,195,240	10	—	3	472	485	60,000	—	2,400	7,254	69,654	59.181	8.499
1928	58	8,051,291	9	—	5	390	404	54,000	—	9,000	6,381	69,381	50.178	8.617
1929	57	8,635,845	5	—	6	316	327	30,000	—	6,060	6,150	42,210	37.865	4.888
1930	74	8,608,782	7	—	10	242	259	42,000	—	7,475	4,139	53,614	30.086	6.228
1931	61	5,430,962	4	—	13	202	219	24,000	—	18,660	3,687	46,347	40.324	8.534
1932	42	2,820,300	1	—	4	81	86	6,000	—	6,750	2,646	15,396	30.493	5.459
1933	43	2,934,252	1	—	1	78	80	6,000	—	48	3,242	9,290	27.264	3.166
1934	50	3,536,403	1	—	2	119	122	6,000	—	2,850	2,160	11,010	34.498	3.113
1935	48	4,342,300	2	1	8	80	91	12,000	6,000	9,900	3,264	31,164	20.957	7.177
1936	54	6,733,770	6	—	14	189	209	36,000	—	8,168	4,707	48,875	31.038	7.258
1937	50	6,563,681	7	—	9	139	155	42,000	—	5,875	4,552	52,427	23.615	7.987
1938	50	4,992,561	2	—	6	78	86	12,000	—	6,600	3,317	21,917	17.226	4.390
1939	48	4,612,125	2	—	3	58	63	12,000	—	5,400	2,135	19,535	13.660	4.236
1940	50	4,734,396	1	—	6	86	93	6,000	—	7,050	3,901	16,951	19.643	3.580
1941	51	6,369,155	3	—	6	113	122	18,000	—	10,050	2,435	30,485	19.155	4.786
1942	52	7,964,829	3	2	2	216	223	18,000	12,000	3,300	5,452	38,752	27.998	4.865
1943	39	5,770,085	4	—	8	179	191	24,000	—	12,096	4,985	41,081	33.102	7.120
1944	36	4,723,929	4	—	5	145	154	24,000	—	5,400	4,119	33,519	32.600	7.096
1945	53	7,325,882	—	—	3	157	160	—	—	3,750	4,260	8,010	21.840	1.093
Total	—	118,162,697	75	3	120	3,581	3,779	450,000	18,000	139,832	83,558	691,390	31.981	5.851

¹ See footnotes 1, 2, and 3, Table 1.

presented with a Certificate of Honor for his part in preventing accidents. The 15 plants are as follows:

Billmeyer dolomite quarry, The J. E. Baker Company, Bainbridge, Lancaster County, Pennsylvania; 234,822 man-hours.

Security limestone quarry, North American Cement Corporation, Hagerstown, Washington County, Maryland; 117,462 man-hours.

Ohio dolomite quarry, The J. E. Baker Company, Millersville, Sandusky County, Ohio; 99,029 man-hours.

Martinsburg limestone quarry, North American Cement Corporation, Martinsburg, Berkeley County, West Virginia; 90,877 man-hours.

Oglesby limestone quarry, Marquette Cement Manufacturing Company, Oglesby, LaSalle County, Illinois; 84,480 man-hours.

Inwood limestone quarry, The J. E. Baker Company, Inwood, Berkeley County, West Virginia; 84,361 man-hours.

Marquette limestone quarry, Marquette Cement Manufacturing Company, Cape Girardeau, Cape Girardeau County, Missouri; 70,792 man-hours.

Blue Mount trap-rock quarry, The J. E. Baker Company, White Hall, Baltimore County, Maryland; 61,848 man-hours.

White Haven sandstone quarry, The General Crushed Stone Company, White Haven, Luzerne County, Pennsylvania; 60,066 man-hours.

Auburn limestone quarry, The General Crushed Stone Company, Auburn, Cayuga County, New York; 47,970 man-hours.

Jordanville limestone quarry, The General Crushed Stone Company, Jordanville, Herkimer County, New York; 44,872 man-hours.

Thomasville limestone quarry, The J. E. Baker Company, Thomasville, York County, Pennsylvania; 42,714 man-hours.

No. 4 trap-rock quarry, Southwest Stone Company, Knippa, Uvalde County, Texas; 37,836 man-hours.

Marquette limestone quarry, Marquette Cement Manufacturing Company, Earlham, Madison County, Iowa; 29,344 man-hours.

Winchester trap-rock quarry, The General Crushed Stone Company, Winchester, Middlesex County, Massachusetts; 27,026 man-hours.

Tables 1 and 2 show the relative standing of the open quarries and underground mines, arranged in ascending order of accident-severity rates of the plants. When two or more plants have accident-free records, the number of man-hours governs the order. Tables 3 and 4 show yearly summary figures from 1926 to 1945. Table 5 shows a yearly combined summary of open quarries and underground mines in the competition. The number of injuries by causes and the days of disability by causes of injuries are shown in Tables 6 and 7. Table 8 gives the average days of disability for temporary injuries at mines and quarries enrolled in the contest. Table 9 gives employment and accident data for crushed stone plants enrolled in the National Crushed Stone Association Safety Competition, 1944 and 1945, covering identical plants for both years and plants enrolled only in 1944 or 1945.

TABLE 6

NUMBER OF INJURIES, BY CAUSES, AT QUARRIES AND UNDERGROUND MINES IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION IN 1945.

Cause	Permanent		Temporary	
	Fatal	Total	Partial	Total
Falls and slides of rock	—	—	—	14
Handling materials or objects	—	—	—	29
Hand tools	—	—	—	12
Explosives	—	—	—	1
Haulage	—	—	—	17
Falls of persons	—	—	—	28
Bumping against objects	—	—	—	3
Falling objects	—	—	—	2
Flying objects or particles	—	—	—	11
Electricity	—	—	—	—
Drilling	—	—	—	13
Machinery	—	—	3	15
Stepping on objects	—	—	—	4
Burns	—	—	—	3
Other causes	—	—	—	3
Total	—	—	3	155
Not stated	—	—	—	2
Grand total	—	—	3	157

The following 16 States were represented in the 1945 contest:

State	No. of plants	State	No. of plants	State	No. of plants
Connecticut	3	Michigan	1	Pennsylvania	12
Illinois	4	Missouri	3	Texas	2
Iowa	1	New York	11	Virginia	2
Kentucky	1	North Carolina	2	West Virginia	3
Maryland	3	Ohio	3		
Massachusetts	1	Oklahoma	1		

Thirty-three plants enrolled in the 1945 competition were also enrolled in 1944. Eight of these plants had accident-free records in both years; 16 had better severity rates in 1945; and 9 had worse severity rates in 1945. The following is a comparison of these identical plants:

Year	Man-hours worked	Total number of injuries	Total number of days of disability	Frequency rate	Severity rate
1944	4,386,217	136	31,359	31.006	7.149
1945	4,405,275	96	3,588	21.792	.814

Year	Number of injuries					Number of days of disability				
	F.	P.T.	P.P.	Temp.	Total	F.	P.T.	P.P.	Temp.	Total
1944	4	..	4	128	136	24,000	..	3,600	3,759	31,359
1945	1	95	96	1,200	2,388	3,588

TABLE 7

DAYS OF DISABILITY BY CAUSES OF INJURIES AT QUARRIES AND UNDERGROUND MINES IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION IN 1945.

Cause	Permanent			Tempo-	Total
	Fatal	Total	Partial	rary	
Falls and slides of rock	—	—	—	240	240
Handling materials or objects	—	—	—	595	595
Hand tools	—	—	—	260	260
Explosives	—	—	—	18	18
Haulage	—	—	—	640	640
Falls of persons	—	—	—	559	559
Bumping against objects	—	—	—	28	28
Falling objects	—	—	—	17	17
Flying objects or particles	—	—	—	60	60
Electricity	—	—	—	—	—
Drilling	—	—	—	561	561
Machinery	—	—	3,750	1,123	4,873
Stepping on objects	—	—	—	112	112
Burns	—	—	—	29	29
Other causes	—	—	—	15	15
Total	—	—	3,750	4,257	8,007
Not stated	—	—	—	3	3
Grand total	—	—	3,750	4,260	8,010

Causes

Fifty-eight percent of the accidents at the 53 crushed stone plants for which causes are given in Table 6, resulted from handling materials, falls of persons, machinery, and haulage. These same causes accounted for 83 percent of the days of disability. Machinery accidents were the most severe and accounted for 61 percent of the days of disability.

SCALE OF TIME LOSSES FOR WEIGHTING DEATHS AND PERMANENT INJURIES SO AS TO SHOW SEVERITY OF INJURIES.

(American Standards Association, October 11, 1945.)

Nature of injury	Degree of disability in percent of permanent total disability	Days charged
Death	100	6,000
Permanent total disability	100	6,000
Arm above elbow, including shoulder joint	75	4,500
Arm above wrist, including elbow	60	3,600
Hand, at or below wrist, above proximal joint of fingers	50	3,000
Thumb, at or below proximal joint, above distal joint	10	600
Thumb, at or below distal joint	5	300
Finger, at or below proximal joint, including middle joint	5	300
Finger, below middle joint, including distal joint	2½	150
Finger, below distal joint	1½	75
Two fingers	12½	750
Three fingers	20	1,200
Four fingers	30	1,800
Thumb and one finger	20	1,200
Thumb and two fingers	25	1,500
Thumb and three fingers	33½	2,000
Thumb and four fingers	40	2,400
Leg, above knee	75	4,500
Leg, at or below knee, above ankle	50	3,000
Foot, at ankle, above proximal joint of toes	40	2,400
Great toe, at or below proximal joint, above distal joint	5	300
Great toe, at or below distal joint	2½	150
Two great toes	10	600
Each toe other than great toe—complete	2½	150
—less than complete	1½	75
One eye, loss of sight	30	1,800
One ear, loss of hearing	10	600
Both ears, loss of hearing	50	3,000

In tabulations for the Competition, temporary disabilities are weighted according to the actual number of calendar days of disability, including Sundays and holidays as stated in Rule 9. Hernia is classed as a temporary disability to be charged with the actual number of calendar days during which the employee was unable to work.

Permanent disability resulting in partial loss of use of a part of the body is charged with the percent of the days lost shown in the scale.

Example: Amputation of finger 300 days
Fifty percent loss of use of finger 150 days

TABLE 8

AVERAGE DAYS OF DISABILITY PER TEMPORARY INJURY AT PLANTS ENROLLED IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION

Year	Underground mines			Open quarries			Total		
	No. of temporary injuries	No. of days of disability	Av. days of disability	No. of temporary injuries	No. of days of disability	Av. days of disability	No. of temporary injuries	No. of days of disability	Av. days of disability
1926	34	533	16	207	4,239	20	241	4,772	20
1927	14	68	5	458	7,186	16	472	7,254	15
1928	68	888	13	322	5,493	17	390	6,381	16
1929	30	617	21	286	5,533	19	316	6,150	19
1930	15	468	31	227	3,671	16	242	4,139	17
1931	4	147	37	198	3,540	18	202	3,687	18
1932	6	165	28	75	2,481	33	81	2,646	33
1933	11	349	32	67	2,893	43	78	3,242	42
1934	13	287	22	106	1,873	18	119	2,160	18
1935	3	249	83	77	3,015	39	80	3,264	41
1936	7	117	17	182	4,590	25	189	4,707	25
1937	3	91	30	136	4,461	33	139	4,552	33
1938	2	133	67	76	3,184	42	78	3,317	43
1939	7	457	65	51	1,678	33	58	2,135	37
1940	8	888	111	78	3,013	39	86	3,901	45
1941	15	169	11	98	2,266	23	113	2,435	22
1942	33	1,213	37	183	4,239	23	216	5,452	25
1943	45	1,123	25	134	3,862	29	179	4,985	28
1944	27	796	29	118	3,323	28	145	4,119	28
1945	22	755	34	135	3,505	26	157	4,260	27
Total	367	9,513	26	3,214	74,045	23	3,581	83,558	23

TABLE 9

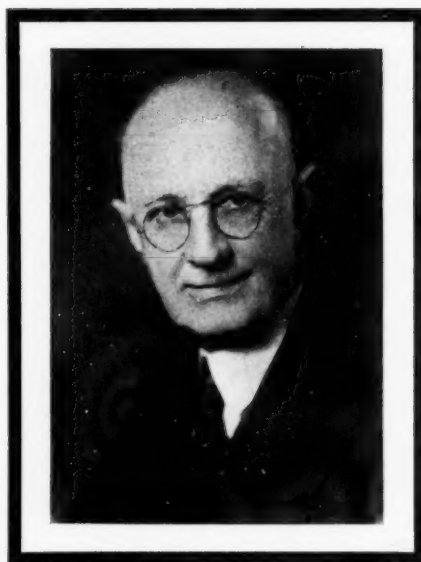
EMPLOYMENT AND ACCIDENT DATA FOR CRUSHED STONE PLANTS ENROLLED IN THE NATIONAL CRUSHED STONE ASSOCIATION SAFETY COMPETITION, 1944 AND 1945, COVERING IDENTICAL PLANTS FOR BOTH YEARS AND PLANTS ENROLLED ONLY IN 1944 OR IN 1945.

	No.	Man-hours worked	Number of injuries ¹					Days of disability ¹					Frequency rate ²	Severity rate ²
			F.	P.T.	P.P.	Temp.	Total	F.	P.T.	P.P.	Temp.	Total		
Plants enrolled in 1944 only ---	3	337,712	—	—	1	17	18	—	—	1,800	360	2,160	53.300	6.396
Identical plants, enrolled both years, 1944 ----	33	4,386,217	4	—	4	128	136	24,000	—	3,600	3,759	31,359	31.006	7.149
Identical plants, enrolled both years, 1945 ----	33	4,405,275	—	—	1	95	96	—	—	1,200	2,388	3,588	21.792	0.814
Plants enrolled in 1945 only ---	20	2,920,607	—	—	2	62	64	—	—	2,550	1,872	4,422	21.913	1.514

¹ P.T., permanent total disability; P.P., permanent partial disability; Temp., temporary disability.

² Frequency rate indicates the number of fatal, permanent, and other lost-time (disabling injuries per million man-hours of exposure; severity rate indicates the number of days of disability per thousand man-hours.

1871



1946

A Tribute to E. J. Krause

BY OTHO M. GRAVES

THE CRUSHED STONE INDUSTRY, has been saddened and grieved by the death on September 30th, of E. J. Krause of St. Louis, Mo. He actively participated in the formation of the National Crushed Stone Association in Chicago on February 7, 1918. He clearly recognized at that time the value to the industry of an effective trade association, for he had been President of the Illinois Crushed Stone Association. At that time he was elected to the Board of Directors of the National Association on which body he served continuously until his death.

He also served for many years on the Executive Committee, retiring because of ill health. In Toronto, Canada, in 1921, he was elected the third President of the Association and served for one term.

As President, as a member of the Board of Directors and of the Executive Committee, "E. J.," as he was affectionately known, brought to Association activities clear vision, sound executive judgment and a charming personality which endeared him to all who knew him. He actively supported the establishment of a testing laboratory in Washington for the Association and continued his helpfulness in all of the research work flowing therefrom. His courtesy and consideration of others was never failing. He was a loyal friend and always sought an opportunity for service to others and to the Association.

E. J. was largely responsible for the growth and development of the Columbia Quarry Co., of which he was President for forty years. The company celebrated this anniversary during the past summer. By the magnificent presents to which all of the Company employees contributed, they evidenced the affection and respect in which he was held.

He was active in the Agricultural Limestone Industry and participated in the organization of the Midwest Agricultural Limestone Institute of which he was President for

several years until the time of his death. He was active in the formation of the Agricultural Limestone Division of the National Crushed Stone Association and was a member of its Board of Directors and Executive Committee from its organization until July, 1946, when he resigned from both bodies because of the condition of his health. He was promptly elected an honorary member of the Board of Directors of the Division.

E. J.'s vision, courage and business judgment expressed themselves in endeavors unrelated directly to the Crushed Stone or Agricultural Limestone Industries. He purchased a small railroad recently which is enjoying its expected successful operation. He was also interested in citrus fruit and nut groves in the South. Years ago he and his brother, Dr. C. H. Krause, produced coal from Illinois mines. At one time he owned one of the finest farms and dairies in southern Illinois. It is not perhaps commonly known that he was a connoisseur of fine arts, nor that he started his business career as a commercial artist. He enjoyed horse-back riding, especially in the very early morning and that avocation did much to maintain his high degree of mental and physical efficiency.

The Crushed Stone Industry, however, will remember E. J. best because of his affectionate and charming personality, his loyal support of Association activities and his constant helpfulness. Indeed, not only the Association, but the Industry has suffered a severe loss.

E. J. Krause was born in Chicago, Ill., August 26, 1871, but his parents moved to St. Louis when he was a small child, and he had ever since been an active citizen of St. Louis.

He is survived by his wife, Louise; three sons, E. J., Jr., Los Angeles, Calif.; Horace C. and Charles H., and two daughters, Mrs. Robert B. Haas, Columbus, Ohio, and Mrs. Paul E. Lau, Grosse Point, Mich. A third daughter, Mrs. Leighton Shields, Boston, Mass., preceded him in death.

¹ From Rock Products, November, 1946

Highway Building—A National "Must"

By CHARLES M. UPHAM

Engineer-Director
American Road Builders' Association,
Washington, D. C.

HIGHWAYS are a vital part of transportation. They directly affect the cost of moving goods and people. Thus they affect the standard of living and the convenience of everyone. It is time, therefore, that America faced the highway construction situation squarely. It is important to 140,000,000 people that the nation's roads and streets receive immediate attention.

Economy talk is heard everywhere today. Citizens and government are counselled to cut here, defer there—abandon this, postpone that. After years of excessive spending, this is a natural note. But there are different ways of economizing. When we undertake to reduce expenses, lighten the tax burden and balance the budget, we should carefully consider the final results. In the long run, will the result be really a saving?

By no stretch of the imagination can holding up or further deferring the highway building program benefit the country. In fact, it has been hindered too much already. Construction lags far behind schedule and is losing ground every day. Highways are a need so fundamental that economy cannot justify depriving people of them.

Roads and streets suffered severely during the war years and relatively little has been done since to repair the damage. The rehabilitation program alone which includes the rebuilding, widening and relocating of well over 100,000 miles of obsolete highways and 30,000 out-worn and out-moded bridges will take years. Making necessary extensions on our highway system and bringing existing highways up to post-war traffic demands call for an expenditure of approximately \$20 billion and at least 15 years in which to do it.

Many new housing projects should be built as rapidly as possible. But roads and streets are as essential to these projects as are light, water and sewer connections. Wherever people live, they must have means of reaching work, pleasures, friends, church, medical aid—all human contacts. We are not providing or maintaining this access when we stop building roads.

Traffic on our highways is fast reaching prewar levels and maintenance costs are mounting, due to

traffic volumes far above the capacity for which the roads were designed. For the first time since 1915, maintenance costs exceeded construction. It is unlikely that 1946 new building will equal the year's maintenance spending. It must be remembered that maintenance simply keeps highways in their original condition. It is not a modernizing force. It adds nothing new.

All costs have risen in the postwar period and it would be surprising if the cost of materials and labor used in road building had not done likewise. This must be considered. When a man buys a suit of clothes, he is making an investment as well as meeting a need. The cost may be more than he is accustomed to pay, but for economic reasons he feels he can not afford to do without until things change.

The same is true with highways. To wait until prices return to the normal days of 1925-1929 would mean ruin for the highway transportation system. It is a sound investment in the future of transportation to go forward as fast as economically possible. To defer the program now would be folly.

One of the several obstacles that has prevented the road program from getting under way has been the difficulty of receiving satisfactory bids and getting them accepted. The reason for this is the steadily rising cost of operations. The contractor hesitates to bid or since he does not know what the price tag will read when he has to pay, he ups his figure to make allowances for possible further advances. This results in a relatively high bid.

The use of an escalator clause in the contract has been suggested as a remedy to take the guess out of bidding and remove the costly contingencies that the contractor allows for in his bid. Naturally, when bids are ridiculously out of line, they are put aside for analysis. Yet in spite of uncertainty, a number of states have made headway in getting projects under contract.

Further proof that immediate highway building is a sound investment is found in the use of highways. Wherever highways are built, business and develop-

ment follow these routes. During the prosperous years of the twenties, highway construction showed a steady upward trend, proving the relation between highway construction and prosperous times. Although the use of the highways continued to increase, the size of the highway program was dropping away sharply during the depression years. This lack of construction activity and failure of highways to meet the need of increasing transportation contributed to the depression.

Need of highway transportation is so great that traffic makes the best of existing conditions though the cost is comparatively higher and the facility of low transportation cost is lacking. This making the "best of it" is reflected in increased expense for the motor vehicle operator. Many tests have shown conclusively that it costs more to drive over poor roads than over good ones. On the other hand, improving highways saves much more than their actual cost of construction.

Figures from the New Jersey Highway Department show that in 1944, the sum of \$17,045,858 was spent on the state's entire road program. In time saved by improving surfaces, by cutting unnecessary travel, by permitting greater speed with safety and by the elimination of traffic obstructions by realignment, the motorists of New Jersey were saved an estimated \$77,115,740 or roughly between four and five times what the roads actually cost.

This is the same state, by the way, that proved traffic accidents could be reduced 76 per cent by introducing safety into highway design. Since our annual loss from highway accidents in dollars and cents is estimated at \$1½ billion annually, it is clear that highway building is an investment that pays real dividends.

In prosperous times, we find more money in circulation. Purchasing power is high. That is the reason why times are good. There is a difference between "expenditures" and "economic investments". No doubt many "expenditures" at this time should be curtailed or deferred but "economic investments" are sound at all times. Highway building is an economic investment at any time.

We need the roads. Certainly it is "penny wise—pound foolish" to permit anything to interfere with supplying this transportation need at once. If the highway construction program is allowed to drag now for any reason, the ill effects will be felt for years to come. It is a national problem in which every citizen, whether he owns a car or not, has a definite stake.

15 Years and \$20 Billion Needed for Our Highways

A PLANNED program of 15 years and from 16 to 20 billion dollars will be required to modernize our present system of streets and highways, Charles M. Upham, engineer-director of the American Road Builders' Association said in a statement issued to highway engineers in October.

This is because the condition of many roads in the United States is a casualty of the war, more than a million miles of rural roads and 95,710 miles of state-controlled highways lack all-weather surfaces and some 75,000 miles of city streets and alleys lack year-round surfaces of concrete, asphalt, tar coating or gravel, Mr. Upham declared.

"With motor vehicle accidents costing 1¼ billion dollars a year, and modern highway design demonstrably able to cut accidents significantly, the cost is not high and the benefits are immeasurable," Mr. Upham said. "In New Jersey, recent changes in engineering design reduced accidents by 76 per cent.

"The need of modernized roads is further shown to be vital when we consider that 49 large cities of the country get all their milk by highway, that 54 per cent of our livestock is hauled by road, and that small business firms ship nearly half their freight by highway, Mr. Upham pointed out. "Moreover," the Road Builders' executive said, "rural education and the quick availability of medical attention find a modern highway system an important factor."

Highways wear out, Mr. Upham observed. Eventually they require extensive repairs, sometimes relocation, in addition to routine maintenance. New types of motor vehicles and increased traffic make changes necessary in both design and construction.

"In 1943, a survey showed that 121,000 miles of roads required widening or rebuilding. The estimated cost was \$3,800,000,000. The relocation of 36,000 additional miles to cost \$2,418,000,000 brought the total cost of rehabilitating obsolete highways to \$6,218,000,000. To this, the survey showed, \$810,000,000 needed to be added to widen or rebuild 30,000 bridges.

"This mid-war stock-taking of badly needed improvements for our roads called for an additional expenditure of \$11,138,000,000 including the federal-aid system, the secondary federal-aid system and the urban highway system. The total cost, therefore, for highway extensions and for the wiping out

(Continued on Page 14)

Highway Officials Emphasize Planning, Safety and Urban Congestion at A.A.S.H.O. Annual Meeting

HIGHWAY officials of 46 States, two Territories and the Federal government, meeting in Los Angeles last week, reported that road construction currently is running at approximately pre-war levels, on a dollar basis, and that the need for replacement and reconstruction is enormous.

It was the 32nd annual session of the American Association of State Highway Officials, which elected C. W. Phillips, of Tennessee, as 1947 President, succeeding M. J. Hoffmann, of Minnesota.

The speeches, resolutions and panel discussions heavily underscored the need for long-range planning, with the achievements of California in that field this year receiving unanimous praise and approval.

The problem of urban traffic congestion also was emphasized, together with the need for widespread support of the "Action Program" adopted in 1946 by the President's Highway Safety Conference.

"Public Works" Concept of Roads Is Challenged

Highlight of the speaking program was an address by Public Roads Commissioner Thomas H. MacDonald, in which he branded as "extremely fallacious" the traditional "public works" concept of highway construction and maintenance.

Under the "public works" concept, the volume of highway construction would be regulated to take up the slack in employment, or to meet other economic and social goals.

This approach, Mr. MacDonald said, ignores the essential services rendered by highway transportation, and the necessity for continuous and planned replacement and improvement of road facilities.

In his address, Commissioner MacDonald also:

Asserted that highways of limited-access design represent the only solution to the acute congestion problem in metropolitan areas;

Reported that 27,218 miles of federal-aid highways, or 14.5 per cent of the country's total, are worn out or obsolete, and require reconstruction;

Pointed out that 14,000 miles of two-lane roads, all main traveled routes, carry more than 3,000 vehicles daily, and should be made four-lane highways;

Underscored the vital role which highway transportation must play throughout the world in sustaining the economies of nations where people today are starving.

User Taxes Compared With Operating Costs

Commissioner MacDonald presented figures showing that total highway expenditures in the U. S. have decreased in recent years, despite the amounts channeled through WPA and other agencies during the depression.

Discussing taxes, he pointed out that 1946 imposts on road users, both federal and state, totaled approximately three quarters of a cent per mile traveled. This is not more than 18 per cent of operating costs, probably less; it represents less than the differential between operating over smooth and rough roadways.

Substantial Federal-Aid Held Essential

Retiring President Hoffmann, in his annual message, said that substantial and continuing federal-aid is essential to progress in developing the nation's highway system, and that repeal of federal road user taxes would jeopardize this program. He emphasized the importance of working out state administrative and fiscal relationships with cities and counties, and urged the officials to extend their efforts in keeping the public fully informed on all major problems.

Congressman J. W. Robinson, of Utah, Chairman of the House Committee on Roads, declared that the 1944 Federal-Aid Highway Act, a milestone in road legislation, has set national policy for years to come, and urged that the program it outlines be pushed vigorously by the state highway departments.

Referring to the complex and urgent metropolitan problems, the Congressman suggested that arrangements be made for immediate financing of necessary

projects by the cities, with the costs amortized over a period of years through federal-aid administered through the state highway departments.

Such a plan, he said, might be feasible under the present law, in cases where cities have long-range programs, and can execute appropriate contracts with the state. If necessary, he said, the federal-aid act could be amended to permit this arrangement.

Origin-and-Destination Surveys Discussed

The need for careful and factual planning of programs was discussed in numerous sessions, with special attention to the work just completed in California and to the origin-and-destination survey techniques perfected during the last three years by the Public Roads Administration, assisted by the Bureau of the Census.

The accuracy and value of these studies have been demonstrated, the discussions disclosed, but their full application has not yet been made. Only one city in the country (Fort Wayne, Indiana) has utilized the surveys to maximum extent in setting up a complete program for improvement of highway and parking facilities to meet future requirements.

A preliminary report was made on the joint study by the P.R.A. and the National Safety Council, in cooperation with numerous highway departments, to determine the relationship between the design of the road and the type and frequency of accidents.

The study indicates that width of pavement, and width of bridges in relation to their approach roads, are major factors. For maximum safety of large traffic volumes, controlled access roads are necessary.

Resolution Asks That C.P.A. Restrictions Be Lifted

One of 13 resolutions approved by the Association on the final day calls upon the Civilian Production Administration to terminate all restrictions on the manufacture, sale and use of road construction equipment, declaring that these controls are unnecessarily impeding highway improvements.

Other resolutions included:

A strong plea for support of the "Action Program" of the President's Highway Safety Conference. The highway officials pledged their cooperation nationally, through their Association, and individually in their own state safety programs;

Commending the Legislature and the California Highway Department on the engineering survey completed in 1946. (See Highway Bulletins Nos. 11 and 12, October 29 and 30, 1946.)

The same thought was expressed by several speakers, including Commissioner MacDonald and President Hoffmann, who said of the California studies:

"They serve to remind us at a timely moment of the tremendous importance of good highway planning to the future progress of our state programs."

Seek Completion of Pan-American Highway

Another resolution asks Congress to adopt a policy furthering completion of the Pan-American Highway, including the provision of funds as needed from time to time.

Another requests the federal government to allocate surplus road construction equipment on a fixed percentage basis, and is critical of the distribution of this machinery up to the present.

The Association asked the Federal Communications Commission to give highway departments the same latitude in the use of two-way radio it has accorded to utilities, truck users and others.

15 Years and \$20 Billion Needed for Our Highways

(Continued from Page 12)

of out-of-date features amounted to \$18,168,000,000 three years ago. With little new construction and insufficient maintenance since that time, it would require approximately 20 billion dollars to enable our highways to meet present transportation demands," Mr. Upham's statement pointed out.

Bottlenecks of materials, machinery and construction are obstacles at the moment, Mr. Upham said in his statement. But with the hoped-for highway program of \$750,000,000 for 1946, construction under contract should reach a peak of 2 billion dollars a year by 1949. After that, it would require at least ten years to complete the job.

"When we remember that 40,000,000 cars are expected to be on our roads by 1950, and that the highway hauling of fresh vegetables, milk, live poultry, livestock and inanimate freight is all expected to increase, the utter necessity of an adequate road program for this country is obvious," Mr. Upham concluded.

MANUFACTURERS' DIVISION

of the

NATIONAL CRUSHED STONE ASSOCIATION

These associate members are morally and financially aiding the Association in its efforts to protect and advance the interests of the crushed stone industry. Please give them favorable consideration whenever possible.

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Portable and Permanent Belt Conveyors,
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phalt Mixers and Finishers, Coal Hand-
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C. G. Buchanan Crushing Machinery Divi- sion of the Birdsboro Steel Foundry and Machine Co.

1941 Furnace St., Birdsboro, Pa.

Primary, Secondary and Finishing Crushers
and Rolls

Bucyrus-Erie Co.

South Milwaukee, Wis.

Excavating, Drilling and Material Handling
Equipment

Cross Engineering Co.

Carbondale, Pa.

Screen Plates and Sections, Perforated Plate,
for Vibrating, Rotary and Shaking Screens

Deister Machine Company

1933 East Wayne Street, Fort Wayne, Ind.

Deister Plat-O Vibrating Screen, Deister
Compound Funnel Classifier

Detroit Diesel Engine Division

General Motors Corp.

13400 West Outer Drive, Detroit 23, Mich.

Light Weight, Compact 2 Cycle Diesel En-
gines and "Package Power" Units for All
Classes of Service

Diamond Iron Works, Inc.

Minneapolis, Minn.

Rock Crushing, Conveying and Transmis-
sion Machinery

E. I. du Pont de Nemours & Co., Inc.

Wilmington, Del.

Explosives and Blasting Accessories

Easton Car and Construction Co.

Easton, Pa.

Quarry Cars, Truck Bodies and Trailers
Electric Heaters for Tar, Asphalt or Bitumen

Ensign-Bickford Co.

Simsbury, Conn.

Cordeau-Bickford Detonating Fuse and
Safety Fuse

Euclid Road Machinery Co.

1361 Chardon Road, Cleveland 17, Ohio

Heavy-Duty Trucks and Dump Trailers for
"Off Highway" Hauls, Loaders for Earth
Excavation

MANUFACTURERS' DIVISION of the NATIONAL CRUSHED STONE ASSOCIATION

Frog, Switch & Mfg. Co.

Carlisle, Pa.

Manganese Steel Department—Manufacturers of "Indian Brand" Manganese Steel Castings for Frogs, Switches and Crossings, Jaw and Gyratory Crushers, Cement Mill, Mining Machinery, etc., Steam Shovel Parts

General Electric Co.

1 River Road, Schenectady N. Y.
Electric Motors

Goodyear Tire & Rubber Co.

Akron, Ohio

Belting (Conveyor, Elevator, Transmission), Hose (Air, Water, Steam, Suction, Miscellaneous), Chute Lining (Rubber)

Gruendler Crusher and Pulverizer Co.

2915 N. Market St., St. Louis, Mo.
Rock and Gravel Crushing and Screening Plants, Jaw Crushers, Roll Crushers, Hammer Mills, Lime Pulverizers

Harnischfeger Corp.

4400 W. National Ave., Milwaukee 14, Wis.
A complete line of Power Excavating Equipment, Overhead Cranes, Hoists, Smootharc Welders, Welding Rod, Motors and Generators

Hayward Co.

50 Church Street, New York City
Orange Peel Buckets, Clam Shell Buckets, Drag Line Buckets, Electric Motor Buckets, Automatic Take-up Reels

Heidenreich Eng. Co.

Newburgh, N. Y.

Hendrick Mfg. Co.

Carbondale, Pa.

Perforated Metal Screens, Perforated Plates for Vibrating, Shaking and Revolving Screens; Elevator Buckets; Hendrick Vibrating Screens

Hercules Powder Co.

Wilmington, Del.
Explosives and Blasting Supplies

Hetherington & Berner Inc.

701-745 Kentucky Ave., Indianapolis 7, Ind.
Asphalt Paving Machinery, Sand and Stone Dryers, Dust Collectors

Illinois Powder Mfg. Co.

124 N. 4th St., St. Louis, Mo.
Gold Medal Explosives

Iowa Manufacturing Co.

Cedar Rapids, Iowa

Rock and Gravel Crushing, Screening, Conveying and Washing Plants, Hot and Cold Mix Asphalt Plants, Stabilizer Plants, KUBIT Impact Breakers, Screens, Elevators, Conveyors, Portable and Stationary Equipment.

Jeffrey Manufacturing Co.

E. First Ave., Columbus 16, Ohio
Material Handling Machinery, Crushers, Pulverizers, Screens, Chains

Kennedy-Van Saun Mfg. and Eng. Corp.

2 Park Ave., New York City
Material Handling Machinery—Crushers, Pulverizers, Vibrating Screens

Kensington Steel Co.

505 Kensington Ave., Chicago, Ill.
Manganese Steel Castings, Dipper Teeth, Crawler Treads, Jaw Plates, Concaves and Hammers

Keystone Driller Co.

Beaver Falls, Pa.
Drills, Power Shovels

The King Powder Co., Inc.

Cincinnati, Ohio
Detonite, Dynamites, and Blasting Supplies

Koehring Co.

3026 W. Concordia Ave., Milwaukee, Wis.
Mixers, Pavers, Shovels, Cranes, Draglines, Dumpers, Traildumps, Mud-Jacks

Lima Locomotive Works, Inc.

Shovel and Crane Division
1108 Lima Trust Bldg., Lima, Ohio
Power Shovels, Draglines and Cranes

Link-Belt Co.

300 West Pershing Road, Chicago, Ill.
Complete Stone Preparation Plants. Conveyors, Elevators, Screens, Washing Equipment, Speed-o-Matic Shovels—Cranes—Draglines and Power Transmission Equipment

Ludlow-Saylor Wire Co.

Newstead Ave. & Wabash R. R., St. Louis, Mo.
Woven Wire Screens and Wire Cloth of Super-Loy, Manga-Loy and all commercial alloys and metals

Mack Manufacturing Corp.

350 Fifth Ave., New York 1, N. Y.
Trucks, Truck-Tractors of All Types and Capacity, Gasoline or Diesel Power Optional

Maguire Industries, Incorporated

Nostrup Division
2010 Broadway, New York 23, N. Y.
Nostrup, Roctreet

Marion Power Shovel Co.

Marion, Ohio
A Complete Line of Power Shovels, Draglines and Cranes

McLanahan & Stone Corp.

Hollidaysburg, Pa.
Complete Pit, Mine and Quarry Equipment—Crushers, Washers, Screens, Feeders, etc.

The National Supply Co., Superior Engine Division

1401 Sheridan Ave., Springfield, Ohio
Diesel Engine Equipment

MANUFACTURERS' DIVISION of the NATIONAL CRUSHED STONE ASSOCIATION

New Holland Machine Co.

New Holland, Pa.
Limestone Pulverizers; Jaw, Roll, and Hammer Crushers; Elevators; Revolving and Vibrating Screens; Dewaterers; Belt and Apron Conveyors; Conveyor Belting; V-Belts; V-Belt Drives; Engines; Electric Motors; Concrete Mixers with or without Power Lifts

Noble Co.

1860 7th St., Oakland 7, Calif.
Batching Plants, Bulk Cement Plants

Nordberg Mfg. Co.

Milwaukee, Wis.
Cone, Gyratory, Jaw and Impact Crushers; Grinding Mills; Stone Plant and Cement Mill Machinery; Vibrating Screens; Grizzlies; Diesel and Steam Engines; Compressors; Mine Hoists; Track Maintenance Tools

Northern Blower Co.

65th St. South of Denison, Cleveland, Ohio
Dust Collecting Systems, Fans—Exhaust and Blowers

Northwest Engineering Co.

28 E. Jackson Blvd., Chicago, Ill.
Shovels, Cranes, Draglines, Pullshovels

Pioneer Engineering Works, Inc.

1515 Central Avenue, Minneapolis, Minn.
Jaw and Roll Crushers, Vibrating and Revolving Screens, Scrubbers, Belt Conveyors, Traveling Grizzly Feeder

Pit and Quarry Publications

538 South Clark St., Chicago, Ill.
Pit and Quarry, Pit and Quarry Handbook, Pit and Quarry Directory, Concrete Manufacturer, Concrete Industries Yearbook

Robins Conveyors Incorporated

270 Passaic Avenue, Passaic, N. J.
Belt Conveyors, Bucket Elevators, Gyrex and Vibrex Screens, Feeders, Design and Construction of Complete Plants

Rock Products

309 West Jackson Blvd., Chicago, Ill.

Ross Screen and Feeder Co.

19 Rector St., New York City
Ross Patent Chain Feeders for Feed Control of All Sizes Rock, Ores, Gravel, etc.

Sanderson-Cyclone Drill Company

South Main St., Orrville, Ohio
All Steel Wire Line, Air Speed Spudder, Large Blast Hole Drills, Drilling Tools and Drilling Supplies

Screen Equipment Co.

9 Lafayette Ave., Buffalo, N. Y.
SECO Vibrating Screens

Simplicity Engineering Co.

Durand, Mich.
Simplicity Gyrating Screen, Simplicity D'centegrator, Simplicity D'watering Wheel

Smith Engineering Works

E. Capitol Drive at N. Holton Ave., Milwaukee, Wis.
Gyratory, Gyrasphere, Jaw and Roll Crushers, Vibrating and Rotary Screens, Gravel Washing and Sand Settling Equipment, Elevators and Conveyors, Feeders, Bin Gates, and Portable Crushing and Screening Plants

St. Regis Paper Co.

2601 O'Sullivan Bldg., Baltimore 2, Md.
Main Office: 230 Park Ave., New York 17, N. Y.
Automatic Filling and Weighing Machines and Multiwall Paper Shipping Sacks

Stedman's Foundry & Machine Works

Aurora, Indiana
Stedman Impact-Type Selective Reduction Crushers, 2-Stage Swing Hammer Limestone Pulverizers

Stephens-Adamson Mfg. Co.

Aurora, Ill.
Belt Conveyors, Elevators, Feeders, Car Pullers, Screens, Skip Hoists, Complete Plants

Taggart Corp.

(See St. Regis Paper Co.)

Taylor-Wharton Iron & Steel Co.

High Bridge, N. J.
Manganese and other Special Alloy Steel Castings

The Texas Co.

135 E. 42nd St., New York City
Asphalts, Lubricating and Fuel Oils

The Thew Shovel Co.

Lorain, Ohio
Power Shovels, Cranes, Crawler Cranes, Locomotive Cranes, Draglines, Diesel Electric, Gasoline. 3/8 to 2-1/2 cu. yd. capacities

The Traylor Engineering & Mfg. Co.

Allentown, Pa.
Stone Crushing, Gravel, Lime and Cement Machinery

Trojan Powder Co.

17 N. 7th St., Allentown, Pa.
Explosives and Blasting Supplies

The W. S. Tyler Co.

3615 Superior Ave., N. E., Cleveland, Ohio
Wire Screens, Screening Machinery, Scrubbers, Testing Sieves and Dryers

Vibration Measurement Engineers

7721 Sheridan Rd., Chicago, Ill.



